D 51512 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2013

(UG–CCSS)

Physics—Complementary Course

PH 3C 05—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 30 Weightage

I. Objective type questions. Answer *all* twelve questions :

1 When light enters from a medium of refractive index n_1 to another medium of refractive index n_2, with angle of incidence and angle of refraction are i and r, respectively, the Snell's law relating these quantities can be written as ———.

2 In the Young's double slit experiment, the fringe width of the interference pattern increases with :

(a) Increase of wavelength. (b) Decrease of wavelength.

(c) Separation of high sources. (d) Decreasing the distance between slit and screen.

3 For Newton's rings formed by reflected monochromatic light, the central ring is :

(a) Bright. (b) Dark.

(c) Coloured. (d) None of these.

4 The grating spectrum is caused by ———.

(a) Dispersion. (b) Polarization.

(c) Reflection. (d) Diffraction.

5 Which optical phenomenon proves that light waves are transverse in nature ?

(a) Reflection. (b) Refraction.

(c) Polarization. (d) Diffraction.

6 Which is the most heavily doped region in a transistor ?

(a) Collector. (b) Emitter.

(c) Base. (d) Battery.

7 The common collector transistor configuration is generally used for ———.

8 Negative feedback ——— the gain of the amplifier.

(a) Increases. (b) Decreases.

(c) Does not change. (d) Increases or decreases.

Turn over

9 In a ruby laser, the energy levels used for laser action are of :

(a) Aluminium. (b) Chromium.

(c) Potassium. (d) Helium.

10 In television transmission, which modulation is used for sound signal ?

(a) Phase modulation. (b) Amplitude modulation.

(c) Frequency modulation. (d) No modulation.

11 Huygens eyepiece ——— be used in telescopes and other optical instruments with which distance and angles are to be measured.

(a) Can. (b) Cannot.

(c) Can or cannot. (d) None of these.

12 A negation following an AND gate is called :

(a) NOT. (b) XOR.

(c) AND. (d) NAND.

(12 × ¼ = 3 weightage)

II. Short Answer Type Questions. Answer all *nine* questions. Each question carries a weight of 1 :

13 What is Format's principle ?

14 Mention two differences between a zone plate and a convex lens.

15 Distinguish between Negative and Positive crystals.

16 Draw the circuit diagram of a basic Zener diode voltage regulator.

17 What do you mean by the angular magnification of a telescope ?

18 What is the principle of light propagation in an optical fiber ?

19 Using a suitable figure, discuss the phenomenon of stimulated emission.

20 What do you mean by population inversion ?

21 What is amplitude modulation ?

(9 × 1 = 9 weightage)

III. Short Essay Type Questions. Answer any *five* questions from seven :

22 A biprism is placed at a distance of 5 cm. in front of a narrow slit which is illuminated by a light of wavelength 589 nm. The distance between the two virtual sources is found to be 0.05 cm. Determine the width of the fringes observed in an eyepiece at a distance of 75 cm. from the biprism.

23 What is the radius of the first zone in a zone plate of focal length 25 cm. for light of wavelength 400 nm ?

24 Determine the minimum number of lines in a grating that will just resolve the sodium lines (589 nm and 589.6 nm) in the first order spectrum.

25 Determine the thickness of a quarter wave plate when the wavelength of light used in 589 nm. Given, the refractive indices of the extraordinary and ordinary light are $\mu_e = 1.553$ and $\mu_o = 1.544$, respectively.

26 Write down the Boolean expression and the truth table for an exclusive OR gate.

27 Calculate the frequency of a Hartley transistor oscillator having $L_1 = 100$ μH, $L_2 = 1000$ μH mutual inductance between the coils M = 20 μH and C = 20 pF.

28 A step index fiber has a core of refractive index 1.55 and clad of refractive index 1.5. Determine the numerical aperture and acceptance angle of the fiber. Assume that light enters the fiber from air.

(5 × 2 = 10 weightage)

IV. Essay Questions. Answer any *two* questions from three :

29 Discuss the interferences of two simple harmonic oscillations of constant phase difference. Obtain an expression for the intensity at a point on a screen placed at a distance.

30 What do you mean by a plane, circularly and plane polarized light ? Discuss briefly the production of plane, circularly and elliptically polarized light.

31 Briefly outline the working of an *npn* transistor. Discuss the different transistor connections using neat figures mentioning the current amplification factor in each case.

(2 × 4 = 8 weightage)